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SPECTROSCOPY.—*Regularities in the arc spectrum of iron.*[1] F. M. WALTERS, JR., Bureau of Standards.

According to the Bohr theory a particular line of the so-called arc spectrum of an element is emitted when the energy of a normal atom changes in a manner governed by quantum conditions. Thus a spectral line of frequency ν corresponds to an energy change of $h\nu = E_i - E_f$ where E_i and E_f are the initial and final states of the atom. A multitude of possible states or energy levels exists for each atom and different spectral lines result from different combinations of these. Further, the different sets of levels are usually polyfold, that is, each so-called state may really consist of two or more slightly different conditions of energy. Intercombinations of these multiple levels give rise to groups of spectral lines which increase in complexity as the multiplicity of the levels involved in their production increases. The frequency differences of the lines are proportional to the energy differences of the associated levels, and when one multiple set of levels enters into combination with two or more different sets, the corresponding groups of lines will repeat the wave number differences characterizing this set of levels. These repeated differences have been shown by interferometer measurements[2] to be strictly constant, and they are, therefore, a positive criterion for the analysis of spectra. In addition to the well-known spectral series and intercombinations consisting of singlets, doublets and triplets, more complex groups of lines were discovered by Popow[3] and very recently still more complicated groups have been found by Catalan[4] in the spectra of manganese and chromium and by Kiess[5] in the arc spectrum of molybdenum. For these complex groups Catalan coined the work "multiplets."

[1] Received May 23, 1923. Published by permission of the Director, Bureau of Standards. Communicated by Dr. W. F. Meggers.

[2] Bureau of Standards Scientific Papers, 329, 414 and 441.

[3] Annalen der Physik **45**: 147. 1914.

[4] Phil. Trans. A. **223**: 127. 1922, Fisica y Quimica 21 p. 84, 1923.

[5] Bureau of Standards Scientific Paper, in press.

The spectra of the chemical elements in the periodic table become more complex, in general, as the right-hand side of the table is approached and the difficulty of classification is correspondingly increased. Thus the spectra of the elements in the first two columns are almost completely classified, and typical series or groups of lines have been indentified for one or more elements in the remaining columns, except the 5th and 8th, for which no significant regularities have heretofore been detected. Of the metals in the eighth column, iron, although its spectrum contains more than 5000 lines, is nevertheless, the best adapted for study because of the following reasons. Since the iron arc was adopted as the source of secondary and tertiary standards of wave-lengths, more of its lines have been measured with high precision and the relative values of the wave-lengths are of first importance in testing the constancy of wave-number differences. Furthermore, the data on temperature classification and Zeeman effect which sometimes assist in detecting spectral regularities, are more extensive for the lines of iron than for any other element in the 8th column. In this preliminary report is presented a classification of about 200 of the stronger lines of the iron arc spectrum in twenty multiplets.

The wave-lengths and intensity and character designations given in Table 1 are taken from the observations of Burns.[6] Wave-lengths were converted to wave numbers (number of waves per centimeter) by the use of a table of reciprocals and corrected to vacuum by the table given by Meggers and Peters.[7] The temperature classification is that of King.[8] The notation for the Zeeman effect, measured by King[9], expresses the observed separations as fractions of the normal effect, the figures in parentheses refer to the parallel components, the others to the normal components.

In Table 1, the lines of each multiplet are given in the order of increasing wave-length. Each of these groups may be readily rearranged to bring in evidence the line structure and separations of the polyfold sets of levels involved in the multiplet. The first three multiplets are rewritten in this manner following Table 1, and will serve as examples.

[6] Lick Obs. Bull. No. 247, vol. 8, 1913.
[7] Bull. Bureau of Standards, **14**: 697, 1918.
[8] Astrophysical Jour. **37**: p. 239. 1913.
Astrophysical Jour. **56**: 351. 1922.
[9] Papers Mt. Wilson Solar Obs. Vol. 2, 1912.

TABLE I—MULTIPLETS IN THE ARC SPECTRUM OF IRON

NO.	M. A.	INT.	$\nu_{VAC.}$	TEMP. CLASS.	ZEEMAN PATTERN	LINE STRUCTURE AND SEPARATIONS
1	3824.444	6R	26140.19	IA	$\frac{(?)3}{2}$	2+3+3+3+1
	3856.373	6R	25923.77	IA	$\frac{(0)3}{2}$	
	3859.913	7R	25900.00	I	$\frac{(0)3}{2}$	415.96
	3878.578	6R	25775.35	II	$\frac{(0)3}{2}$	288.10
	3886.287	7R	25724.24	IB	$\frac{(0)3}{2}$	184.17
	3895.659	5r	25662.35	IB	$\frac{(0)3}{2}$	89.92
	3899.711	6r	25635.67	IB	$\frac{(0)3}{2}$	
	3906.484	5r	25591.23	IB	$\frac{(0)3}{2}$	240.20
	3920.261	6r	25501.31	IB	$\frac{(0)3}{2}$	199.53
	3922.917	6R	25484.03	IB	$\frac{(0)3}{2}$	139.73
	3927.925	6r	25451.45	IB	$\frac{(0)3}{2}$	71.12
	3930.304	7R	25436.14	IB	$\frac{(0)3}{2}$	
2	2981.448	4r	33531.00	I		2+3+3+3+3
	2983.571	4r	33507.13	I		
	2994.434	6R	33385.54	I		415.96
	3000.951	5r	33313.08	I		288.04
	3007.284	4r	33242.94	I		184.13
	3017.630	5r	33128.96	IA		89.95
	3020.495	5r	33097.53	II		
	3020.643	6r	33095.93	I		
	3021.076	6R	33091.17	I		
	3024.035	5r	33058.78	IA		411.20
	3025.846	5r	33039.01	I		294.40
	3037.392	5r	32913.43	I		145.40
	3047.608	6r	32803.10	I		70.16
	3059.090	5r	32679.98	I		
3	5208.610	4	19193.65	IV	$\frac{(?)3}{2}$	2+3+3+3+1
	5215.195	4	19169.41	IV	$\frac{(?)3}{2}$	
	5217.405	4	19161.28	V	$\frac{(?)3}{2}$	240.17

TABLE 1—*Continued*

NO.	M. A.	INT.	PVAC.	TEMP. CLASS.	ZEEMAN PATTERN	LINE STRUCTURE AND SEPARATIONS
3	5229.84	2	19115.72	V	$\frac{(0)3}{2}$	199.52
	5253.479	2	19029.71			139.70
	5263.321	5	18994.15	V	$\frac{(0)3}{2}$	71.07
	5273.178	3	18958.64			
	5283.634	7	18921.12	IV	$\frac{(0)3}{2}$	284.33
	5302.315	5	18854.45	V	$\frac{(0)3}{2}$	272.56
	5324.196	6	18776.96	IV	$\frac{(0)3}{2}$	175.26
	5339.949	3	18721.57	V	$\frac{(0)3}{2}$	86.01
	5393.185	4	18536.78	IV	$\frac{(0)3}{2}$	
4	3057.451	5r	32697.50	II		3+3+3+2+1
	3067.250	5r	32593.04	II		
	3075.725	5r	32503.25	II		448.45
	3083.745	4r	32418.71	II		351.26
	3091.581	4r	32336.56	II		257.74
	3099.898	4r	32249.79	II		168.92
	3099.968	4r	32249.05	II		
	3100.305	4r	32245.56	II		344.00
	3100.668	4r	32241.78	II		261.52
	3116.632	5	32076.65	III		173.14
	3125.663	6	31983.99	III		86.77
	3134.109	5	31897.78	III		
5	3355.517	1	29793.13			3+3+3
	3356.332	1b	29785.88	IVA		448.48
	3359.496	3	29757.84	IIIA		351.24
			29535.23			257.77
	3396.386	1	29434.64			
	3404.301	2	29366.20	IIIA		476.52
	3410.905	1	29309.36			358.49
	3426.393	4	29176.87	IIIA		
	3452.279	4	28958.11	III		
6	3396.982	3	29429.48	IIIA		3+3+2
	3397.642	2	29423.76	IIIA		
	3401.523	4	29390.18	III		351.31
	3417.265	1	29254.81			257.68
	3426.994	2	29171.76	IIIA		168.99

TABLE 1—*Continued*

NO.	λI. A.	INT.	νVAC.	TEMP. CLASS.	ZEEMAN PATTERN	LINE STRUCTURE AND SEPARATIONS
6	3442.676	2	29038.87	IIIA		
	3446.966	1	29002.73			390.58
	3473.497	1	28781.22			252.04
7	3466.501	2	28839.29	IIIA		2+3+3
	3483.012	4	28702.58	IIIA		
	3513.822	5	28450.93	II		448.50
	3521.264	5r	28390.79	I		351.28
	3526.167	5	38351.32	II		257.77
	3558.522	5r	28093.55	II		
	3565.383	6R	28039.50	I		388.36
	3570.102	7R	28002.43	I		311.80
8	3540.715	2	28234.85	IIIA		1+2+3+3
	3554.121	4	28128.34	IIIA		
	3585.322	6r	27883.56	II		351.28
	3585.708	5	27880.57	II		257.72
	3586.989	6r	27870.61	II		168.91
	3608.860	6R	27701.70	I		
	3618.769	6R	27625.84	I		474.92
	3631.464	6R	27529.29	I		354.28
	3647.845	6R	27405.65	I		244.78
9	3687.458	6R	27111.27	I	$\frac{(0)3}{2}$	2+4+3+3+2
	3709.250	6r	26952.00	II	$\frac{(0)3}{2}$	448.49
	3727.622	6R	26819.15	II	$\frac{(?)3}{2}$	351.29
	3734.869	9R	26767.12	II	$\frac{(0)3}{2}$	257.73
	3743.356*	3r	26706.35	IA	$\frac{(2,0)4,2,0}{4}$	168.90
	3749.487	8R	26662.76	II	$\frac{(0)4}{3}$	
	3758.234	7R	26600.71	II	$\frac{(0)5}{4}$	344.14
	3763.792	6R	26561.42	II	$\frac{(0)2}{2}$	289.24
	3767.194	6R	26537.43	II	Unaffected	218.44
	3887.880	6R	26392.53	II	$\frac{(2,0)4,2,0}{2}$	144.92
	3795.004	6r	26342.98	II	complex	

* Given by Burns as a pair but measured three times as a reversed line.

TABLE 1—*Continued*

NO.	λI. A.	INT.	ΡVAC.	TEMP. CLASS.	ZEEMAN PATTERN	LINE STRUCTURE AND SEPARATIONS
9	3798.512	6r	26318.65	II	$\frac{(0)3}{2}$	
	3799.548	6r	26311.47	II	$\frac{(0)3}{2}$	
	3837.136	1	26053.74	IV		
10	3812.966	6r	26218.89	II		3+3+3+3+2
	3820.430	8R	26167.66	II	complex	448.50
	3825.886	8R	26130.35	II	complex	351.31
	3834.227	7R	26973.50	II	complex	257.73
	3840.443	6R	26031.30	II	$\frac{(1, 0)3, 2, 1}{2}$	168.93
	3850.820	5	25961.16	II	complex	
	3865.526	6r	25863.38	II	$\frac{(6)3, 0}{4}$	
	3872.506	6r	25815.77	II	$\frac{(2, ?)4, 3, 2, 1}{2}$	411.20
	3876.044	1	25792.20	III		294.46
	3878.024	6r	25779.05	II	$\frac{(2)4}{3}$	145.38
	3887.053	6r	25719.16	IB	$\frac{(1)3?}{2}$	70.16
	3898.013	4	25646.86	IB?	$\frac{(3)6?}{2}$	
	3917.185	5	25521.31	IB		
	3940.885	4	25367.84	IA?	(0)2	
11	4039.689	3	20238.55	IB	$\frac{(0)8}{5}$	2+3+3+3+2
	4994.133	3	20017.93	IB	$\frac{(0)3}{2}$	448.51
	5012.073	4	19946.28	IB	$\frac{(0)7}{5}$	351.30
	5041.079	3	19831.51	IB	$\frac{(0)4}{3}$	257.72
	5051.643	4	19790.04	IB	$\frac{(?)4}{3}$	168.92
	5079.742	3	19680.55	IB		
	5083.344	4	19666.61	IB	$\frac{(?)6}{5}$	292.27
	5107.454	3	19573.77	IB	$\frac{(?)2}{2}$	227.88
	5123.727	4	19511.63	IB	Unaffected	164.88
	5127.364	3	19497.77	IB	$\frac{(?)7}{4}$	106.78

TABLE 1—*Continued*

NO.	M. A.	INT.	ν VAC.	TEMP. CLASS.	ZEEMAN PATTERN	LINE STRUCTURE AND SEPARATIONS
11	5142.934	3	19438.75	IB	(?)3, 0 / 2	
	5150.845	4	19408.90	IB	(?)8 / 5	
	5151.916	3	19404.86	IB	?	
12	5269.538	10	18971.72	IB	(0)6 / 5 ?	3+3+3+2+1
	5328.044	7	18763.41	IB	complex	448.51
	5371.496	7	18611.62	IB	complex	351.30
	5397.135	6	18523.21	IB		257.72
	5405.780	6	18493.59	IB	(1, 0)4, 2 / 4	168.92
	5429.701	6	18412.11	IB	complex	
	5434.527	6	18395.76	IB	unaffected	240.20
	5446.922	6	18353.90	IB	(2, 1)4, 3, 2, 1 / 2	199.50
	5455.617	6	18324.66	IB	(6)3 / 4	139.68
	5497.521	4	18184.98	IB	(3, 0)6, 3, 0 / 4	71.10
	5501.471	4	18171.92	IB	?	
	5506.785	4	18154.40	IB	?	
13	2501.14	3b	39969.72	II		2+3+3+3+1
	2510.843	6b	39815.25	II		
	2518.11	6b	39700.36	II		415.80
	2522.86	5r	39625.63	II		288.08
	2527.44	4r	39553.82	II		183.95
	2529.143	6b	39527.20			90.12
	2529.83	4	39516.46	III		
	2535.613	6	39426.34	III		344.00
	2540.97	6	39343.20	III		261.46
	2545.987	3	39265.71	III		173.21
	2549.616	6	39209.92	III		86.56
14	2719.037	7r	36766.84	II		3+3+3
	2720.910	7r	36741.55	II		
	2723.582	6r	36705.50	II		415.84
	2737.312	6r	36521.39	II		288.04
	2742.408	6r	36453.53	II		184.13
	2750.145	6r	36351.00	II		89.95
	2744.072	8	36431.44	II		
	2756.332	5	36269.38	I		390.57
	2772.112	6	36062.94	III		251.99

TABLE 1—*Continued*

NO.	AI. A.	INT.	VAC.	TEMP. CLASS.	ZEEMAN PATTERN	LINE STRUCTURE AND SEPARATIONS
15	2912.161	8	34328.72	I		1+2+3+3+3
	2929.006	7	34131.31	I		415.90
	2936.903	7r	34039.53	I		288.12
	2941.343	8	33988.12	I		184.16
	2947.876	5r	33912.84	I		89.91
	2953.943	5r	33843.18	II		344.16
	2957.370	5r	33803.97	II		289.22
	2965.258	5r	33714.06	II		218.46
	2970.107	4r	33659.02	I		144.94
	2973.137	4r	33624.72	I		
	2973.236	4r	33623.60	I		
16	3649.308	3	27394.67	IA		1+2+3+3+3
	3679.915	5r	27166.82	IA		
	3683.056	4	27143.66	IA		415.92
	3705.567	6R	26978.76	I		288.08
	3707.828	3u	26962.43	I		184.11
	3719.938	8R	26874.53	I		89.91
	3722.565	6R	26855.57	IA		
	3733.319	6R	26778.22	IA		292.29
	3737.135	7R	26750.88	I		227.86
	3745.563	7R	26690.69	I		164.89
	3745.900	6R	26688.31	IA		106.76
	3748.264	6R	26671.45	I		
17	5569.631	5	17949.53	IV	complex	3+3+3+2+1
	5572.857	5	17939.15	IV	complex	292.22
	5576.106	4	17928.69	IV	unaffected	227.90
	5586.772	6	17894.46	IV	complex	164.90
	5602.965	3	17842.76	IV	$\frac{(6)\ 3,\ 0}{4}$	106.75
	5615.663	6	17802.37	IV	$\frac{(0)5}{4}$	
	5624.563	5	17774.23	IV	?	384.33
	5658.542	1	17667.50			272.54
	5658.836	4	17666.58	IV	?	175.28
	5709.395	3	17510.15	IV	?	85.93
	5712.150	2	17501.71			
	5784.69	1	17282.23			
18	4147.675	4	24103.11	IB	?	1+2+3
	4202.032	7r	23791.33	II	complex	584.72
	4250.791	8	23518.41	II	complex	407.65

TABLE 1—*Continued*

NO.	M. A.	INT.	VVAC.	TEMP. CLASS.	ZEEMAN PATTERN	LINE STRUCTURE AND SEPARATIONS
18	4271.764	8r	23402.96	II	$\frac{(0)5}{4}$	
	4307.910	8r	23206.58	II	$\frac{(0)7}{6}$	388.37
	4325.770	9r	23110.76	II	$\frac{(0)7}{8}$	311.80
19	3969.263	7r	25186.48	II	complex	2+3+2
	4005.250	7b	24960.20	II	complex	
	4045.822	8R	24709.91	II	$\frac{(0)6}{5}$	584.70
	4063.604	8R	24601.78	II	$\frac{(0)12}{11}$	407.61
	4071.748	7r	24552.57	II	$\frac{(0)2}{3}$	476.57
	4132.064	7	24194.19	II	complex	358.40
	4143.874	7	24125.21	II	?	
20	4229.752	1	23635.39			
	4291.472	1	23295.48	IA		1+2+3+2
	4294.132	6	23281.05	IB	?	584.70
	4337.052	5	23050.64	IB	$\frac{(1)?}{2}$	407.62
	4367.910	1	22887.83	IA	$\frac{(0)8}{7}$	474.87
	4383.548	10R	22806.18	II		354.29
	4404.752	8r	22696.40	II	$\frac{(0)8}{7}$	244.80
	4415.127	8r	22643.06	II	?	

Structure of Multiplet 1

25900.00—240.19—26140.19
415.97 415.95
25484.03—240.21—25724.24—199.53—25923.77
288.10 288.10
25436.14—199.53—25635.67—139.68—25775.35
184.22 184.12
25451.45—139.78—25591.23—71.12—25662.35
89.92
25501.35

Structure of Multiplet 2

33905.93—411.20—33507.13
415.95 415.96
32679.98—411.19—33091.17—294.37—33385.54—145.44—33530.98
288.07 288.01 288.04
32803.10—294.43—33097.53—145.41—33242.94—70.14—33313.08
184.10 184.16 184.12
32913.43—145.35—33058.78—70.18—33128.96
89.95
33039.01

Structure of Multiplet 8

18776.96—384.32—19161.28
240.18 240.16
18536.78—384.34—18921.12—272.53—19193.65
199.55 199.50
18721.57—272.58—18994.15—175.26—19169.41
139.70 139.70
18854.45—175.26—19029.71—86.01—19115.72
71.07
18958.64

King[10] gives a table of twenty-one lines which appear in the furnace spectrum of iron at a temperature of 1400°C. Twelve of the stronger of these lines give multiplet No. 1.

Multiplet No. 2 is novel in that it has the same difference repeated three times in two instances. It will be noted that the lines involved are all reversed lines and of nearly the same temperature class. This anomaly occurs also in the multiplets given as Nos. 9 and 10.

Multiplet No. 3 is interesting in that the differences 240.17, 199.52, 139.70, and 71.07 are here related to the frequency so that in a given triplet, the larger difference occurs between the greater frequencies, while in multiplet No. 1, with the same differences, the greater difference occurs between the smaller frequencies involved in a given triplet.

The above-mentioned multiplets may be regarded as typical and the others are presented in Table 1 without individual comment at this time. It will be noted that there are altogether thirteen sets of separations involved in the twenty multiplets, one set recurring in nine multiplets. The total number of lines in Table 1 is 212. These include 102 of the 134 lines described by Burns as reversed in the arc and most of the lines of temperature classes I and II in King's furnace spectra are here represented. The correlation of these multiplets with temperature classification is seen to be fairly satisfactory, but inspection of the Zeeman patterns show that these data are homogeneous for some groups and quite discordant for others.

Some interesting relations have been found to exist between the different multiplets but a discussion involving a physical interpretation of these regularities is deferred until the spectrum has been more fully analyzed. A systematic analysis of all the available data on both arc and spark spectra of iron is in progress and the complete results of this investigation will appear later as a scientific paper of the Bureau of Standards.

[10] Astrophysical Jour. 45: 370. 1922.

BOTANY.—*Note on* Schizocasia Regnieri. K. KRAUSE, Berlin-Dahlem. (Communicated by PAUL C. STANDLEY).[1]

Among the plants collected in the Republic of Salvador by Dr. Salvador Calderón I have found a cultivated aroid which is to be identified as *Schizocasia Regnieri* L. Linden et Rod. This species, which is said to be a native of Siam, is cultivated as an ornamental plant in the tropics and in several hothouses of European and North American botanic gardens, but, as in the case of some other much cultivated aroids, until the present time it has not been known in flower. Because the Salvadorean specimen was collected in flowering state, I can now give, in addition to my diagnosis in the *Pflanzenreich* and to the earlier descriptions in the *Illustration Horticole* and the *Gardeners' Chronicle*, the following description of the inflorescence.

SCHIZOCASIA REGNIERI L. Linden et Rod. in Illustr. Hortic. 17: *pl. 2.* 1887; Gard. Chron. 2: 328. 1888; Krause in Engl. Pflanzenreich IV. 23E: 117. 1920.—Tota planta usque 2.5 m. alta. Pedunculus teres superne circ. 1 cm. crassus. Spathae tubus convolutus anguste ovoideus, 4 cm. longus, 2 cm. diametiens, lamina oblonga, apicem versus longe sensimque angustata, quam tubus 4–5-plo longior, expansa ad 5 cm. lata. Spadix in toto fere 2.5 dm. longus, in vivo ut videtur flavido-albus; inflorescentia feminea cylindrica 3 cm. longa, 1.6 cm. crassa, interstitium sterile valde constrictum, 1.5 cm. longum, 6–7 mm. crassum; inflorescentia mascula cylindroidea, 4–5 cm. longa, 1.5 cm. crassa; appendix sterilis anguste elongato-claviformis, apice acutata, leviter curvata, 1.5 dm. longa, medio 1–1.2 cm. crassa, sursum attenuata. Flores feminei 4-gyni, pistillis late ovoideis depressis, 1 mm. longis, stigmate subcapitato leviter 4-lobo coronatis; flores masculi steriles synandrodiis cylindricis depressis directione spadicis compressis atque elongatis; flores masculi fertiles synandriis cylindricis vertice truncatis medio leviter excavatis, fere 2 mm. longis, 1 mm. latis, thecis anguste oblongis fere totam longitudinem synandrii occupantibus.

San Salvador, cultivated (*S. Calderón* 599).

[1] A specimen of a plant of the family Araceae was forwarded recently by the U. S. National Museum to the Berlin Botanic Garden for identification by Dr. K. Krause, the foremost authority upon this extremely difficult group. The specimen was collected by Dr. Salvador Calderón, an enthusiastic student of the Central American flora, who has made an extensive and valuable collection of Salvadorean plants and to whom the writer is under deep obligations for many courtesies extended during a recent collecting expedition in Salvador. From this material Dr. Krause has prepared the accompanying account, which completes the description of a striking ornamental plant whose characters have been hitherto but imperfectly known.—P. C. S.

ZOOLOGY.—*Notes on* Paratylenchus, *a genus of nemas.* N. A. Cobb. U. S. Department of Agriculture.

The following paragraphs contain new information with regard to the lip region, vestibule, spear guide, structure of the spear, median bulb, salivary glands, deirids (cervical papillae), renette, eggs and their deposition, and gonism of *Paratylenchus* Micoletzky 1922.

	a	b	c	V	stylet	tail
Paratylenchus nanus n. sp.	3.7	4.3	4.5	4.2	2.	0.41 mm

The transparent, colorless, naked cuticle, about 1.5 microns thick, is traversed by plain, transverse striae, 2.0 microns apart except near the extremities, all alike and fairly easy of resolution, which are materially altered on the lateral fields by the presence of wing regions, about one-seventh as wide as the body, beginning on the neck and ending on the tail. The optical expression of the wings on living specimens usually consists in four parallel longitudinal lines on each lateral field, the two outer of which are fainter than the two inner. Very slightly oblique longitudinal striae of the subcuticle, all alike, due to the attachment of the musculature, are rather easily to be seen in nearly all regions of the body. The contour of the body is crenate or very faintly serrate-crenate. There are no dermal appendages and there are no series of pores to be seen in the cuticle. On the neck opposite the excretory pore, lat. 22.2,* *there is a papilla on each lateral line,* and, leading inward, ventrad and slightly backward from the middle of each papilla is an obscurely sinuous element connecting with the nervous system. These two organs are therefore *believed to be deirids* ("cervical papillae").

The neck, which is cylindroid posteriorly, and to a considerable extent also anteriorly, becomes decidedly convex-conoid farther forward, and ends in a rounded or subtruncate, continuous head compassing about thirty annules of the cuticle, which presents a somewhat depressed, very minute, central mouth opening, closely surrounded by *six equal, exceedingly minute lips.* The truncation of the head occurs at the lip region, which has at this point, that is at the anterior extremity of the nema, a width of about two microns. The lip region is supported by a faintly visible six-ribbed, refractive, somewhat dome-shaped, cuticular framework, six to seven microns across at the base, and about two-thirds as "high" as it is wide. The more or less immobile lips are usually closed.

* *The Word "Latitude" in Descriptive Nematology.* I have lately come to use the word "latitude" in a conventional sense in dealing with nema anatomy, and find it so useful as to lead to this attempt more accurately to define the word as thus used.

The meaning of latitude in this connection arises from geographical usage, but in nematology the term applies to a transverse plane or section of the organism, and not to a circle on the surface only, as in geography, and it has not seemed desirable to have two sorts of latitude, such as north and south.

One hundred degrees of latitude is assumed, with zero at the anterior extremity of the organism. Thus an element of the organism in latitude 50 would be at the middle; and in latitude 100 at the end of the tail. The terms can be abbreviated as in geography so as to be short and specific. Thus: *lat. 60.*

In the case of nemas, which are so nearly round in cross section, a similar use of the word "longitude" sometimes becomes useful, the ventral line being taken as the zero line, the dorsal line thus becoming 180.

The conventional use of the words latitude and longitude in this way is more or less "logical", and very easily acquired, and, according to my experience, is a decided saving in time and space, and has the merit of definiteness, as well as brevity.

There is a small *combined vestibule and spear guide*, about as wide as the lip region and some ten microns long, more or less visible on account of the refractive nature of its elements. This portion of the labial structure has for one of its main functions the guidance of the spear when in action. The vestibular part is about four microns deep and varies somewhat in diameter according to the attitude of the lips and spear. Leading backward from the base of the vestibule there is a symmetrical set of outwardly bowed, somewhat flexible, rather slender, longitudinal elements constituting the main portion of the spear guide. The relatively very robust spear is about twice as long as the base of the head is wide. It ends posteriorly in a distinctly three-lobed expansion toward one-third as wide as the base of the head, the dorsal lobe being slightly farthest back, and sometimes at least presenting a dorso-posterior condyle. It is somewhat behind, and in a line with, the axil of the dorsal lobe that the *dorsal salivary gland empties into the oesophageal lumen*. The spear often tapers more or less regularly throughout its length; nevertheless there is a distinct basal part, comprising about two-fifths of the whole, set off by a minute but distinct junction mark, and averaging about one-sixth as wide as the corresponding portion of the head. At its distal end the spear is exceedingly finely pointed. Well developed muscles for the protrusion of the spear are readily seen and often lie rather close to the spear,—not forming any very marked swelling when at rest. Anteriorly there are *six of these muscles*,—one passing to each sector of the labial framework.

No amphids have been seen. There are no eyespots.

The oesophagus is tylenchoid and presents a very definite, somewhat *pine-apple-shaped, non-muscular valveless cardiac swelling*, half as wide as the base of the neck. The very long, large, rather ob-clavate, median swelling, which is two-thirds as wide as the middle of the neck, is set off abruptly behind, but is decurrent in front and reaches to, and somewhat includes, the base of the onchium; in its posterior part it presents a *well-developed, elongated-fusiform, triplex valve*, occupying one-third of the diameter, to which are attached the usual radial muscles for the opening of the valve in the act of swallowing. An interesting peculiarity of the median swelling is that the contained robust tubular oesophageal lining, which is *disposed in a single loop or coil when at rest, takes on this attitude without much disturbance to the evenness of the contour of the swelling* itself, thus showing the "clavate swelling" to be a distinctly two-fold affair,—partly (posteriorly) muscular, and partly (dorsally throughout) glandular, and with the two tissues so little connected that the glandular part is comparatively separate and responds but little to the movements of the tubular lining. Ordinarily one would expect the anterior narrower part of such a long median swelling to curve or coil along with the lining. Though the limits of the true median bulb (not the clavate swelling but the included median bulb more properly speaking), are often somewhat indefinite anteriorly, it may properly be described as ellipsoidal, two-thirds as wide as the neck and two and one-half times as long as wide; in other words the *entity of the median muscular bulb is not entirely lost*. · Behind the pharynx the oesophagus is one-sixth, at the nerve ring only about one-tenth, in front of the cardiac swelling about one-eighth, and finally one-half, as wide as the corresponding portion of the neck. The lining of the oesophagus is tubular and narrow, and distinct except in the posterior glandular bulb,—most distinct in the clavate swelling.

There are *well developed salivary glands*. The nucleus of one of these organs may be seen in the dorsal sector of the cardiac swelling, as already described,—dorsad and occupying the major part of it,—and emptying into the oesophageal lumen near the onchium. It is doubtful if salivary secretion passes also into the base of the fusiform median valve, though there seem to be two subordinate nuclei in the cardiac swelling.

There are two or three somewhat ellipsoidal organs, half as wide as the body, about two-thirds as wide as long, located just behind the base of the neck, and closely associated with the beginning of the intestine. These regularly darken in Flemming's solution and are as yet of unknown significance. There is no cardia. The thick walled intestine, which is set off from the oesophagus by a rather faint cardiac collum one-half as wide as the base of the neck, presents a faint, though fairly capacious lumen. It is composed of cells of such a size that probably only about two are presented in each cross section. It becomes at once two-thirds as wide as the body. From the very inconspicuous, continuous anus, the rectum, which is also very inconspicuous, extends inward and forward. There is no distinct pre-rectum. The numerous, colorless granules found in the cells of the intestine, the largest of which are about one-tenth as wide as the body, namely about two microns in diameter, are not so arranged as to give rise to a tessellated effect. Sometimes the cells throughout the intestine are uniformly filled with granules; more often the granules are absent here and there, so as to create a "segmented" effect.

The tail, which compasses about twenty annules of the cuticle, is conoid, subarcuate, and tapers from in front of the anus to the rather blunt, or sometimes subacute, unarmed, symmetrical terminus. There is no spinneret. There are no caudal glands and there are no caudal setae.

Apparently the lateral chords are about one-third as wide as the body. The rather prominent excretory pore is located just behind the nerve ring and the excretory duct can be followed *inward and backward along the right lateral chord* at least as far as the middle of the body.

The nerve ring is oblique, of medium size and accompanied, fore and aft, by numerous nerve cells, some of which lie as far forward as opposite the middle of the median oesophageal swelling.

The single female sexual organ is outstretched forward. From the unusually large, depressed and very conspicuous vulva, the vagina, which is large, extends inward obliquely forward, three-fourths the distance across the body. Its walls are rather strongly cutinized. The larger anterior lip of the vulva may be slightly elevated. The body of the nema decreases a little in diameter rather suddenly at the vulva and tapers more rapidly thence backward. The thin-shelled, smooth, elongated egg is nearly thrice as long as the body is wide and measures about 60 x 20 microns. Only one egg occurs in the uterus at a time. A prolate *compact mass of sperm cells*, often comprising some two to five hundred minute, spherical, refractive elements, *occurs regularly in the uterus* of newly adult females; this sperm mass is often two-thirds to three-fourths as wide as the body. From the formation and size of the sperm cells it is concluded that the *species is syngonic*. No males have been seen among about fifty females, many gravid, from two North American regions. The medium sized ovary is usually cylindroid posteriorly, and tapers anteriorly; it averages to be about one-third as wide as the body. Toward fifty ova, arranged for the most part single file, are to be seen in the ovary. There is practically no post-vulvar rudiment of a sexual organ.

Fig. 1. Anterior part of a female *Paratylenchus nanus*.

Habitat: Found in soil about the roots of grasses, Devil's Lake, North Dakota, April, 1915; and Four Mile Run, Falls Church, Va., August, 1922. Flemming's solution to glycerine jelly. In many respects this species closely resembles *Tylenchus macrophallus* de Man, but differs in the following particulars;—the spear is somewhat longer and possibly somewhat more robust; the striation is coarser; the body is wider; the tail of *nanus* compasses twenty annules while that of *macrophallus* appears to compass about fifty; opposite the spear in *nanus* there are about twenty-five to thirty annules, while in *macrophallus* there appear to be about forty. Should opportunity occur it would perhaps be advisable to re-examine the median oesophageal region of *macrophallus*. For the present at least it seems best, unless the undiscovered male of *nanus* should prove to be extraordinarily like the male of *macrophallus*, to regard the two species as distinct. *Paratylenchus* is related to the very well-defined genus *Iota*, a genus whose numerous representatives typically are minute, very short, very broad, coarsely annuled, rather inflexible nemas found in acid soils, and having the single outstretched female sexual organ emptying through a vulva located very close to the minute, inconspicuous anus and often possessing external coarse retrorse cuticular elements,—ridges, scales, spines, fringes, etc., according to the species. There is a number of as yet unpublished species of which it is not easy to make a satisfactory assignment as between *Iota* and *Paratylenchus*. The unknown males of *nanus*, if such exist, may be expected to throw more light on the generic relationships. *P. nanus* may be synonymous with *P. bukowinensis* Micoletzky, 1922.

$\frac{10.}{4.8}$ $\frac{26.}{5.1}$ $\frac{31.}{5.6}$ $\frac{55}{5.1}$ $\frac{93.}{3.1}$ 0.36 are the measurements of a living specimen of *P. nanus* under slight pressure and therefore a little flattened, and furthermore showing a neck-length unaltered by fixation and preservation.

Paratylenchus anceps n. sp. $\frac{24.}{5.3}$ $\frac{28.}{5.3}$ $\frac{34.}{5.3}$ $\frac{1}{4.6}$ $\frac{92.67}{3.6}$ 0.28 *P. anceps* so closely resembles *P. nanus* that only the differences need be here noted. The striae are one micron apart. The optical expression of the wings is a pair of refractive parallel lines whose distance apart is about equal to the width of two annules of the cuticle. The conoid neck becomes convex-conoid at the head, at the front of which the lip region is about four microns wide. The spear guide is six microns long, and the spear about half as long as the neck, the long slender anterior part comprising three-fourths or four-fifths of the whole. The three-lobed, flattish basal bulb of the spear is about one-fourth as wide as the corresponding portion of the neck, that is about four microns wide. The somewhat elongated-pyriform or pineapple-shaped posterior bulb is three-fifths as wide as the base of the neck. The deirids are near the base of the neck. The tail is slightly conoid to the broad, rounded terminus, which is half as wide as the base of the tail. The vulva was about to appear at the same relative position as in *P. nanus*. In all other respects almost precisely as in *P. nanus*.

Habitat: Roots of *Umbellularia californica*, Riverside, California, 1912.

PROCEEDINGS OF THE ACADEMY AND AFFILIATED SOCIETIES

ENTOMOLOGICAL SOCIETY OF WASHINGTON

354TH MEETING

The 354th meeting was held January 4th, 1923, in Room 43 of the New National Museum, with Vice-President A. G. BÖVING in the chair and 36 persons present.

Mr. ROHWER gave a résumé of the last meeting of the Executive Committee, stating that the Committee had approved certain changes in editorial practices and that beginning with Vol. 25 the inside of the back cover would be used for editorials and the outside for current notes. It is the plan that while these editorials and notes will be of timely interest, they will not contain scientific information which needs to be preserved.

The report of the recording secretary, C. T. GREENE, was read and accepted.

The report of the corresponding secretary-treasurer was read by Mr. S. A. ROHWER and accepted.

The auditing committee, Messrs. A. N. CAUDELL and A. G. BÖVING, examined the Treasurer's books and reported them correct.

Dr. E. F. PHILLIPS, of the Bee Culture Laboratory, extended an invitation to the Society to visit the laboratory at Somerset in the near future.

Program:

Presidential Address by the retiring president, A. B. GAHAN on *The rôle of the taxonomist in present day entomology*. Man's first interest in insects probably came about through their ravages upon his person rather than upon his food supplies. Briefly tracing the history of the science from its possible prehistoric beginning down through recorded history to the present time, he sought to show that the whole immense entomological structure of to-day is based upon the work of the taxonomist; that without the trained systematist to identify and describe the species of insects, the economic worker was largely helpless. The world-wide interest in economic entomology has resulted in creating a veritable army of economic workers, while the number of systematists are called upon to do the determinating work in a large group of insects for all of the economic workers of the world. As a consequence, the work of the economist often times suffers exasperating delay because he can not get proper identifications promptly, and at the same time the taxonomist is discouraged because sees himself hopelessly swamped with routine determination work and cut off from doing any of the constructive classification work which he had planned.

The remedy would seem to be in an immediate increase of the number of working systematists, but unfortunately this remedy cannot be applied, because trained systematists are not available, and if they were available it is very doubtful whether funds would be forthcoming from federal, state, or private institutions for their employment. The work of the taxonomist, even though it is the foundation of all entomological investigation, does not have the popular appeal which the economic phase of the work does and hence lacks the popular appreciation and support which it deserves.

In discussing the address Dr. BAKER expressed the regret that so few people really made use of revisionary papers after they were published, and stated that while it seemed that such papers should relieve the taxonomist from considerable work of identification actually they did not, and that such revisions apparently failed to accomplish one of the purposes for which they were written.

Dr. ALDRICH stated that entomological courses in the larger universities had been changed considerably of late, and that only comparatively recently had any institution offered a course in taxonomy. This change in the curriculum of the larger universities should in time produce more taxonomists.

The paper was also discussed by Messrs. HYSLOP, BRIDWELL, SNODGRASS, HEINRICH, and SASSCER.

Second paper: Dr. J. M. ALDRICH. *A manuscript autobiography of S. W. Williston.* Dr. ALDRICH read the greater part of this manuscript which Dr. Williston wrote in 1916, about two years before his death. This dealt with the period of his childhood and early manhood and continued through a period of about eighteen years after graduating from college, during which he had a continuous struggle to obtain a foothold in science.

355TH MEETING

The 355th meeting was held February 1, 1923, in Room 43 of the New National Museum, with President Dr. L. O. HOWARD, in the chair and 30 persons present.

Program:

E. GRAYWOOD SMYTH: *A trip to Mexico for parasites of the Mexican Bean Beetle.* The speaker arrived in Mexico City on May 14th, 1922, and left there for the return trip on November 14th. Practically all studies and collecting were performed in the states of Morelos, Puebla and Vera Cruz, and the Federal District. In the lower altitudes, the beetle was not found in injurious numbers at the towns visited except at Cuernavaca. In the Federal District, on the high central plateau, there seems to be but one, and rarely two, generations of the beetle in a year, as in New Mexico, the first appearance of the adults being governed by the rainy season. Adults first appeared in early June, the first eggs during latter June, and the first larvae during the first week of July. Larvae were not large enough nor abundant enough to be injurious until the latter part of July. From that date on they thrived in abundance until October 9th, when a heavy frost killed all the bean plants in the Federal District.

No parasite was found of either the egg or adult of *Epilachna*. The only parasite encountered was a Tachinid fly, of about the size of the house fly, which attacks the larvae. It is apparently of a new genus and new species, and is being named by Dr. Aldrich. What was apparently this same fly was found attacking a related beetle, *Epilachna mexicana*, that feeds on a wild plant of no economic importance. This Tachinid was found only at or near Mexico City and at Cuernavaca. The first puparium was reared from an *Epilachna* larva on August 31st, and from that date the flies increased in numbers until early October, by which time they were parasitizing from 30 to 50 per cent of *Epilachna corrupta* larvae. It was not known why the flies were so late in making their appearance.

A total of 1866 living puparia of this fly, or *Epilachna* larvae parastized by the fly, were shipped and brought to the States, and approximately 50 per cent of these are now being held in hibernation at the Birmingham Laboratory for the coming spring. About 90 per cent of these came from the Federal District, from a town called Coapa. The author believes that this fly, if successfully colonized at Birmingham, would spread rapidly and do much toward control of the bean beetle.

Few predacious enemies were found, the only common one being a species of *Stiretrus* (Hemiptera, Pentatomidae), which was not sufficiently abundant to be of control value. A large number of egg masses of another predacious

bug, *Zelus* sp., collected on Agave plants near bean fields, were shipped to Birmingham, but the young nymphs, when reared at the latter place, refused to feed on *Epilachna* larvae.

As to wild food plants: the large numbers of leguminous plants and trees were examined for *Epilachna* in Mexico, only two were found to harbor the beetle. One is a wild climbing bean, *Phaseolus* sp., abundant along streams, the other a wild weed known as beggar-weed, or tick trefoil (*Meibomia* sp.) The latter harbored large numbers of bean beetles of all stages, and was believed to be the bettle's native wild food plant.

This paper was discussed by Messrs. ALDRICH, BRIDWELL, HOWARD and SCHWARZ.

Second paper: Dr. A. C. BAKER, *A history of the study of plant lice.*

Notes: J. C. BRIDWELL discussed the occurrence of the clover seed chalcid in the seeds of *Astragalus.*

Some months ago the speaker had reported the discovery of *Bruchophagus funebris* in pods of a species of *Oxytropis* (*O. lamberti*), a genus closely related to *Astragalus.* It is now possible to record an additional instance of attack upon an *Astragalus* by a *Bruchophagus.* This was discovered in a specimen of *Astragalus douglasii* in the National Herbarium collected on June 25, 1891 by Coville and Funston near Tehachipi, Kern County, California, at an elevation of 1000 metres. The *Bruchophagus* was accompanied in its attacks by *Acanthoscelides pullus* (Fall) and had at first been mistaken for a *Eurytoma* parasitic upon the Bruchid. The material from its age and its condition after having been extracted from the seed is not in the best of condition for determination and in it Mr. Gahan sees certain apparent differences of sculpture and color which do not permit him to positively determine it as *funebris* and suggest its belonging to another species, the question of its identity requiring biological evidence for its answer.

The finding of *Bruchophagus* in pods so different from the fruit of the previously known host plants in *Trifolium* and *Medicago* as the compact ovoid pods of *Oxytropis lamberti* and the large bladdery membranous pods of *A. douglasii* does not seem so strange when it is recalled that the oviposition is done early in the development of the young pod. How far the finding of additional host plants of *Bruchophagus* will effect practical control remains for investigation.

356TH MEETING

The 356th meeting was held March 1, 1923, in Room 43 of the New National Museum, with Vice-President Dr. A. G. BÖVING in the chair and 38 persons present.

Mr. ROHWER, for the Executive Committee, stated that since the last meeting the Society had received a communication from the Secretary of the International Commission of Zoological Nomenclature requesting that a committee be appointed to prepare preliminary reports on questions of Entomological Nomenclature referred to the Commission. President Howard had appointed as the Society's Committee, Messrs. ROHWER, HEINRICH and BAKER; and since the announcement of the Committee the Commission had referred three distinct questions to its Chairman.

F. W. Poos was elected to membership in the Society.

Program:

R. E. SNODGRASS: *The anatomy and metamorphosis of the apple maggot* (Rhagoletis pomonella *Walsh*).

The following generalizations probably apply to most of the *Cyclorrhapha:*

1. The true larval head has been invaginated to form a prepharyngeal part of the larval alimentary canal. The functional part of the larval head is a mere remnant of the original head.

2. The buds of the imaginal head are carried into the thoracic cavity by the involution of the larval head.

3. The cephalopharyngeal skeleton of the larva is a chitinization in the true larval pharynx, in the walls of the invaginated head, and in the pouches of the latter.

4. The mouth hooks of the larva are located in a part of the invaginated larval head which was either the back part of the original head, or the neck. They appear to be special cuticular larval organs moved by special muscles. No evidence of their mandibular nature has yet been produced.

5. The dorsal spiracles of the larva and pupa are special breathing organs secondarily developed in connection with the dorsal longitudinal trunks of the tracheal system. The spiracles of the adult first appear on the puparium, and are developed in connection with the lower tracheal trunks. The two sets of spiracles are entirely independent of each other.

The larva molts inside the puparium, casting a fourth skin which remains as an envelope about the pupa, unbroken until the fly emerges. The fly leaves both the pupal skin and the prepupal or fourth larval skin inside the puparium.

7. The pupa obtains air through the larval tracheal trunks attached to the anterior larval spiracles of the puparium, these trunks being ruptured inside the fourth larval skin a short distance back of the spiracles.

8. The imaginal buds of appendages belong in all cases to the pupal stage. They may secondarily begin their development in early larval stages or in the embryo, but only in cases where the external larval appendage is entirely gone.

Second paper: CARL HEINRICH, *A revision of the North American moths of the subfamily Eucosminae of the family Olethreutidae*. Pierce's paper opens a new system of classification. In this genitalia take the place of the old wing venation type of classification. In time all species will be described from the male genitalia.

Notes: A. N. CAUDELL spoke of the collection of *Grylloblatta campodeiformis* Walker in California by H. S. Barber.

Dr. SCHWARZ exhibited two specimens of *Mylabris cichorii* L. and said this is a beneficial species, being used for medicinal purposes. This species is often eaten when the Chinese want to commit suicide.

Dr. ALDRICH exhibited a photograph of a group of Dipterists taken in Boston at the recent meeting in December 1922.

J. C. BRIDWELL presented the following three notes:

1. *The habits of* Bruchus bixae.

In 1820 Drapiez described a species of *Bruchus* from Brazil which he believed bred in the seeds of annatto and called it *Bruchus bixae* from the generic name of the host plant, *Bixa orellana*. Since many old specific names of Brucidae based on plant names were in error and this record of a *Bruchus* in this plant so far removed from the legumes in its natural relationships and in the nature of the seeds and pods has never been confirmed, it has been a matter of interest to find what seems to be this species bred from this host plant collected by Dr. Schwarz in Panama. In this material was a considerable lot of the capsules and seeds of Bixa infested by *Bruchus bixae*. The adult Bruchids slip in between the partly opened valves of the pod to oviposit upon the seeds in a sheltered position much as its allies *B. pruininus* and

B. limbatus oviposit in the partly opened pods of *Leucaena*, *Pithecollobium* and various species of *Acacia*. No eggs were seen deposited upon the pods.

The seeds are irregularly pyramidal broadest and flattened at the summit about 4 mm. broad and 5 mm. long with a peculiar scar-like structure at the summit. The rest of the surface of the seed is covered with small masses of a soft, reddish-orange waxy substance from which the annatto of commerce is derived, the source of most commercial cheese and buttercolor and of some inferior varnish stains and dyes for silk. The eggs are deposited singly upon the seed and a single Bruchus is nourished by a seed. The cotyledons are broad and foliaceous disposed between thick masses of soft brittle albumen which is largely consumed by the larva during its development as in the case of the Bruchidae attacking the seeds of *Hibiscus*, *Ipomoea* and *Convolvulus*.

The eggs are nearly hemispherical, but little flattened by the copious cement substance and show but little reticulation on the surface. The larvae as usual bore directly into the seed when emerging from the egg.

The present species may be expected to continue breeding indefinitely in the annatto seeds as long as they are kept at a temperature high enough, but little injury is done to the seeds so far as the coloring matter is concerned. Their presence, however, is undesirable and they would be likely to destroy seed designed for planting. The maceration of the seed in boiling water in extracting the color would doubtless destroy the insects contained in the seed.

2. *Retarded development in* Eurytoma rhois.

What was believed to be this species was found very commonly by Miss Marion Van Horn in the seeds of *Rhus glabra* and *R. typhina* during the winter of 1921–22 in the vicinity of Washington. The material collected in January had the larvae full-fed and in a very thin membraneous coccoon lining the seed cavity. The material was brought into the laboratory of the Division of Stored Product Insects and held for breeding out. Few adults emerged, but on the examination of the seeds in February 1923 a considerable part of them had transformed and died without emerging probably owing to the excessive heat and dryness of the laboratory. There were also in the seeds a considerable number of living full-fed larvae. There is then in this species of phytophagous chalcid a phenomenon of retarded development such as has been recorded for the clover seed chalcid and some of the Opiine Braconidae. It is likely that most of the seed chalcids will be found to have the same ability to remain dormant in the full-fed larva for extended periods under adverse conditions of drought or subnormal temperatures and this will need to be guarded against in the control and quarantine of such insects. This phenomenon is doubtless far more common than has been recorded for it is questionable if insects in regions with a variable winter climate or those arid regions where effective rainfall may be absent for a year or more could survive if compelled to depend upon steady straightforward development in conformity with the calendar.

The seeds of *Ceanothus americanus* are infested in this vicinity by a seed chalcid not yet bred. As in other cases the seeds often show no external sign of infestation. The larva completely destroys the seed leaving only the coverings.

3. *Pupae of the walnut hull maggot living two years* (Rhagoletis suavis Loew).

During the fall of 1920 the writer secured many walnut hull maggots in and near Glen Echo, Maryland. The puparia from these were brought into the laboratory of the Division of Stored Product Insect investigations. Emergence of 23 adults was noted on March 8, 1921. From that time until June 21 scattering emergence continued, usually not more than one

each day. The material, having become badly infested by mites, was then fumigated. Another small lot was overlooked and remained uncared for until the latter part of the winter 1921–22 when several puparia were found to contain pupae in a living condition. An effort was made to secure emergence from this lot by keeping them moist but without success. Several pupae remained alive until the latter part of the summer of 1922 but all were dead by the middle of November 1922, thus remaining alive as pupae for nearly two years. This material had been left in glass without soil. No inhabited room would seem to be much more unfavorable for dipterous pupae than this laboratory since in the winter it is overheated and the air is exceedingly dry, the temperature reaching 80° to 85°F. daily. Under certain conditions, then, walnut maggots may not complete their transformations in a single year but can remain in the puparium for two years if not more. While this observation was fragmentary, undoubtedly this is normal to the insect's life history, since a species dependent on an uncertain crop such as the nuts of the walnut and butternut could hardly survive if a single year's failure of its food would starve it out. This result would be avoided if some pupae held over to another summer or longer.

F. P. KEENE of the Pacific Coast Station of the Division of Forest Insects made a few remarks on the control of the pine bark beetles in Southern Oregon. During the past year the insect damage dropped 72%. Mr. Keene exhibited a chart showing the damage to the trees in Southern Oregon and Northern California caused by insects and fire.

CHAS. T. GREENE, *Recording Secretary.*

AN APPEAL FOR AID TO AUSTRIAN SCIENTISTS

There has recently been referred to the WASHINGTON ACADEMY OF SCIENCES a report on the condition of Intellectual Life in Austria, from the committee on Intellectual Cooperation of the League of Nations. This was referred by the Board of Managers to a committee consisting of A. S. HITCHCOCK, VERNON KELLOGG, and H. L. SHANTZ, who have been authorized by the Board to issue the following statement.

The report on intellectual life in Austria outlines the deplorable conditions at the universities, the very meager salaries (in depreciated crowns) received by the professors, and the high cost of living. Attention is called to the work of the Academy of Sciences at Vienna, which institution has been obliged to discontinue subscriptions to publications and to cease printing reports of its proceedings.

Relief along certain lines is now being afforded. The American Relief Administration is still continuing a so-called "professors' mess" which is providing a daily meal of excellent quality to more than three hundred professors and instructors at a merely nominal price. Although the American Relief Administration has given up all of its other work (such as child feeding) in Austria it still carries on this special relief for intellectuals in Vienna, Graz, and Innsbruck, that is, in each university city. The Rockefeller Foundation is just making arrangements to set up a considerable number of "fellowships" to assist the younger men of the Austrian university faculties. In addition, the Foundation is making some financial provision for the purchase of laboratory equipment and supplies in the laboratories of medical schools. It has also been arranged to pay subscriptions to American medical journals for these medical schools.

It is evident that there is a very real need for necessities other than food. The table of salaries given in the report shows that an ordinary professor in the University receives per month the equivalent of about 150 Swiss francs ($30.00). The cost of living is very high when compared with the salary received but is low when compared with prices in this country. It is clear that 10 dollars contributed for relief becomes greatly magnified when translated into crowns (exchange being now about 14 dollars per million crowns). In this connection may be quoted from Dr. Kellogg's report in Science (April 6, 1923) concerning contributions to Russian Exiled Intellectuals in Berlin when $1200 were collected and distributed, 10 or 12 dollars to each person, "I hope that each donor will realize how much his money is doing. Ten dollars make the difference between suicide and keeping alive some of these people." Intellectual workers as a class are worse off than most other classes since the adjustment of their salaries to cost of living takes place much more slowly. So large a proportion of a professor's salary must go for food that little is left for clothing and other necessities. Owing to the present boundaries of Austria many necessities must be imported at prices far beyond the reach of a scientist's salary. How to get a pair of spectacles or a pair of shoes is a harassing problem that a few American dollars can solve. Since coal also must be imported the buildings are not heated. The vast herbarium of the Naturhistorisches Museum has not been heated since 1914. Working under such circumstances warm clothing is sorely needed but, except for those with friends in America, the people are still wearing the threadbare garments of several years ago. Nothing is left of a professor's salary for the needs of the intellectual life. Concerning the last the report says, "Owing to the rate of exchange, a barrier, which is becoming more difficult to surmount, has been set up between Austria and the rest of the world, and this prevents all intellectual intercourse, all contact between Austrian science and the science of other countries. In short intellectual life is threatened with extinction through being abandoned, isolated, and starved."

It is suggested that the most effective method by which Washington scientists can aid the intellectual workers of Austria is by direct contributions from individual members of the Academy to individual scientists in that country with whom they have established contact personally or by correspondence.

There are probably many, however, who do not have personal friends in Austria but who wish to contribute for the sake of preventing the collapse of scientific investigation in that country.

Contributions may be sent to Mrs. Agnes Chase, Smithsonian Institution, who will represent the Chairman of the committee during his absence in South America. The Committee hope there may be a wide response to this appeal as there is a very pressing need.

It is suggested that donors indicate whether the gift should be sent (a) to an individual, or (b) to a class of scientists, or (c) to the Vienna Academy of Sciences or other institution, or (d) unrestricted, and (e) whether for a particular purpose.

It should be impressed upon donors that a gift of five or ten dollars will be a very real benefit and will be greatly appreciated, and that aid from members of the Academy will demonstrate the solidarity of international science.

There will be no overhead expenses in connection with transmitting gifts. Mrs. Chase will pay postage and fee for registering.

SCIENTIFIC NOTES AND NEWS

At the Bureau of Standards Physics Club, Monday, May 14, Dr. L. B. TUCKERMAN made an informal report on the lectures delivered at the Franklin Institute by Sir J. J. THOMSON on *The electron in chemistry*.

Dr. PAUL BARTSCH, U. S. National Museum, left April 29 for Porto Rico on a collecting trip.

Dr. C. N. FENNER of the Geophysical Laboratory, Carnegie Institution of Washington, left on May 14 to spend the summer in the Katmai region, Alaska, to continue his studies of the phenomena of the 1912 eruption of Katmai Volcano.

Dr. A. S. HITCHCOCK, Smithsonian Institution, left in May for South America where he will make botanical collections. Three months will be spent in Ecuador, the work being a continuation of the coöperation between the U. S. Department of Agriculture, the U.S. National Museum, the Gray Herbarium, and the New York Botanical Garden in studying the botany of northern South America. About three months will be spent in Peru and Bolivia studying grasses for the Department of Agriculture.

Mr. NEIL M. JUDD, curator of American Archeology, U. S. National Museum, left Washington on May 4 to resume his explorations at Pueblo Bonito, New Mexico.

Mr. ELLIOT WOODS, architect of the Capitol, died at Spring Lake, New Jersey, on May 22, 1923 in his sixtieth year. He was born near Manchester, England, February 2, 1864, of American parents. Mr. Woods had been employed in the office of architecture in Washington since 1884. He was largely responsible for the plans of many public buildings, including the Senate and House office buildings and the Arlington amphitheater. His interest in science was mainly in astronomy and electricity. He was a member of the Washington Society of Engineers and of the Philosophical Society.